Chapter 7

Noise

7.1 Primary Issues

Sand and gravel mining involves the operation of heavy equipment for extended periods each day. The operation of this equipment can generate noise, which could potentially impact nearby residents.

The primary issue analyzed in this section is:

- Would noise levels resulting from the project exceed regulatory standards at nearby residences?

7.2 Affected Environment

This section describes the existing noise environment in the project area. Information in this section is based primarily on a technical report prepared by McCulley, Frick, and Gilman for the Maury Island Mining Operation Expanded Environmental Checklist (1998).

7.2.1 Background Information on Noise

7.2.1.1 What is Noise and How is it Measured?

Sound travels through the air as waves of minute air pressure fluctuations caused by some type of vibration. In general, sound waves travel away from the noise source as an expanding spherical surface. As a result, the energy contained in a sound wave is spread over an increasing area as it travels away from the source. This results in a decrease in loudness at greater distances from the noise source.

Sound level meters measure the actual pressure fluctuations caused by sound waves, with separate measurements made for different sound frequency ranges. The decibel (dBA) scale used to describe sound is a logarithmic scale which accounts for the large range of audible sound intensities. The nature of the dBA scale is such that

individual sound levels for different noise sources cannot be added directly to give the sound level for the combined noise source. For example, two noise sources producing equal sound levels at a given location will produce a combined sound level 3 dBA greater than either sound alone. When two sound sources differ by 10 dBA, the combined sound level will be 0.4 dBA greater than the louder source alone.

People generally perceive a 10 dBA increase in sound levels as a doubling of loudness (noise). For example, a 70 dBA sound level will be perceived by an average person as twice as loud as a 60 dBA sound level. People generally cannot detect differences of 1 to 2 dBA between noise sources; however, under ideal listening conditions, differences of 2 or 3 dBA can be detected by some people. A 3 to 5 dBA change in the sound level would probably be perceived by most people under normal conditions.

7.2.1.2 How Do Environmental Conditions Affect Noise?

When distance is the only factor considered, sound levels from isolated point sources of noise typically decrease by about 6 dBA for every doubling of distance from the sound source. Conversely, moving half the distance closer to a point sound source increases the sound level by 6 dBA. The degree of impact also depends on who is listening and on existing sound levels in the area. If background sound levels are high, introducing a new sound source would tend to have less impact than if background sound levels are low.

Sound levels at different distances can also be affected by factors other than the distance from the noise source. Topographic features and structural barriers that absorb, reflect, or scatter sound waves can increase or decrease sound levels. Atmospheric conditions (wind speed and direction, humidity levels, and temperatures) can also affect the degree to which sound is attenuated over distance.

7.2.1.3 How Do People Perceive Noise Levels?

The human ear does not respond equally to all sound frequencies. Therefore, when considering the effects of sound on people, it is necessary to consider the frequency response of the human ear. Instruments are designed to respond to or ignore certain sound frequencies. The frequency weighting network most often used to evaluate environmental noise is the A-weighting network, which reduces the measured sound pressure level for low-frequency

sounds while slightly increasing the measured pressure level for some high-frequency sounds (1 kHz to 3 kHz) and then reducing as the frequencies increase. Measurements from instruments using this system are reported in "A-weighted decibels" or dBA. All sound levels in this section are provided in A-weighted decibels. Table 7-1 shows sound levels produced by common sources.

For a given sound source, factors affecting the impact at a receiver include the distance from the source, the frequency of the sound, the absorbency of the intervening terrain, the presence or absence of obstructions, and the duration of the event. The degree of impact also depends on who is listening, existing sound levels, and when the event takes place.

7.2.1.4 How is the Significance of Noise Impacts Assessed?

Although standards of significance for noise relate to the exposure of people to severe sound levels and substantial increases in sound level sources, people often express concerns about the possible audibility resulting from a project and related issues of sleep disturbance and quality of life.

Audibility is a complex phenomenon because it depends on the characteristics of the intrusive sound with respect to the characteristics of background sound levels. It would not be uncommon for a highly tonal sound, such as music or an alarm, to be distinctly audible even when the absolute level of the sound is well below (i.e., 5 to 10 dBA less than) the background sound level.

The relationship between audibility and annoyance is also complex and extremely subjective. The fact that a sound is audible does not necessarily mean that it will be annoying or cause a problem. Because of the difficulty in assessing the audibility of sound and related annoyance, audibility alone is not used in this EIS to evaluate the significance of impacts. The question of whether sound levels resulting from the mine would exceed regulatory standards is addressed in Section 7.3, Impacts.

7.2.2 Regulatory Overview

7.2.2.1 King County Noise Limits

The King County Code establishes limits on the levels and durations of noise crossing property boundaries. Allowable maximum sound levels depend on the zoning of the noise source and the zoning of the receiving property (Table 7-2).

King County's noise limits can be exceeded for certain periods of time as shown below:

- 5 dBA exceedance for no more than 15 minutes in any hour; or
- 10 dBA exceedance for no more than 5 minutes of any hour; or
- 15 dBA exceedance for no more than 1.5 minutes of any hour.

King County's noise code also identifies noise sources and activities that are exempt from the noise limits described above:

- sounds created by stream traffic on public roads;
- sounds created by warning devices (such as back-up alarms); and
- sounds from blasting and from construction equipment are exempt from the standards during the day (7 a.m. to 10 p.m. weekdays and from 9 a.m. to 10 p.m. on weekends).

7.2.2.2 Existing Land Uses and Zoning

The project site is designated as a Mineral Resource Area in King County's Comprehensive Plan and is zoned for mining (see Chapter 9, Land and Shoreline Use). Mining has taken place on the site at variable rates since the 1940s, with relatively low rates of extraction over the past 20 years. According to the King County Noise Code, the project site would be considered an industrial noise source.

The project site is bordered by Puget Sound to the south, forest in the northwest corner, individual residences to the west, and the communities of Gold Beach and Sandy Shores to the northeast and southwest, respectively. For these land uses, the applicable noise limits (Table 7-2) would be for an industrial source affecting rural residential receivers.

7.2.3 Existing Sound Levels

Sound levels were measured at two locations in the Sandy Shores and Gold Beach communities to characterize existing sound levels in the vicinity of the project site. Sound levels were measured from 5 p.m. on February 16, 1998 to 11:00 a.m. on February 17, 1998. Average sound levels at both locations during the day ranged from 43 to 53 dBA. During the evening hours, sound levels ranged from 37 to 46 dBA. Sound level measurement locations are shown in Figure 7-1 and summarized in Table 7-3.

7.3 Impacts

7.3.1 Would noise levels resulting from the project exceed regulatory standards at nearby residences?

7.3.1.1 Overview

In general, sound levels resulting from mining would not exceed applicable sound level standards. In later phases of the mining operation, noise from nighttime barge-loading operations could exceed the regulatory standards at some residential locations under certain wind or other atmospheric conditions, as discussed later in this section.

7.3.1.2 Methods Used to Evaluate Impacts

Project-related impacts were evaluated using the Environmental Noise Model (ENM), a computer-based program (RTA 1989). The model estimates sound levels after considering the noise reductions or enhancements caused by distance, barrier effects provided by intervening topography, ground surfaces (including water), wind, and atmospheric stability, and absorption.

The ENM evaluates impacts based on the sound power levels of the noise sources operating on the project site. Sound power levels for operating equipment expected to be used at the project site were based on measurements of similar equipment operating at other active sites.

The ENM estimates sound levels for any reasonable set of meteorological conditions. For this analysis, meteorological conditions consisting of a neutral atmosphere were evaluated with and without a 2 meter/second (4.5 mph) wind blowing from the

sound source toward the receivers. A 2 meter/second wind was used because it could noticeably increase the sound levels of distant sources, but would not significantly affect the background sound level. This meteorological condition results in worst-case sound conditions. Higher wind speeds could also increase the sound levels at distant sources, but would also increase the background sound levels.

7.3.1.3 Proposed Action

Construction Noise. Sound levels on the project site would increase beginning with the reconstruction of the conveyor system and repairs to the loading dock. Construction noise would depend on the type of equipment being used and the amount of time it is in use. Table 7-4 identifies sound levels associated with typical construction equipment. Pile driving would be one of the loudest construction activities, resulting in daytime noise for about two weeks. Initial construction activities would be approximately 1,000 to 1,500 feet from the nearest residential locations.

The sound levels shown in Table 7-4 only take into account distance attenuation. Topography on the site would likely make construction sound levels at 1,000 feet less than those shown. At a distance of 1,000 feet from the project site, noise levels from construction activities would not result in significant impacts. In addition, construction would occur only during the daytime hours and would be exempt from the King County Noise Code.

Operational Noise. Sound levels resulting from the project would not exceed applicable sound level standards except that, in later phases of the mining operation, noise from nighttime barge-loading operations could exceed the regulatory standards under certain wind or other atmospheric conditions, as discussed later in this section.

Onsite sound sources associated with operation of the mine would include:

- bulldozers and/or loaders used to mine material;
- a loader to load material into a hopper feeding the conveyor system;
- a conveyor carrying material from the mining area to the processing and barge loading areas;

- loading of barges, including noise from the conveyors and the tugs; and

- trucks delivering materials to and from the site.

Under the Proposed Action, barge loading could occur 24 hours a day. Other activities would vary on a project-by-project basis, but would not occur outside of 6 a.m. to 10 p.m. Monday through Friday and 9 a.m. to 6 p.m. on Saturdays. The applicant has proposed a number of measures to reduce sound levels during mining (see Section 7.4, Mitigation Measures).

To characterize the potential impacts, sound levels of similar types of equipment operating at an active mining operation were recorded and used in the noise model (Table 7-5).

Impacts under calm conditions (0 meter/second wind) and with a 2 meter/second wind speed are shown in Tables 7-6 and 7-7, respectively. Modeling was completed for each of the six phases of the project as shown in Figure 2-1 in Chapter 2:

- Phase 1 - Excavation of the existing active area

- Phase 2 - Excavation to the northeast

- Phases 3 and 4 - Excavation to the property boundaries on the west side of the site

- Phases 5 and 6 - Excavation to the property boundaries on the east and northeast sides of the site

The maximum daytime activity in any one hour (shown as “Day” in Tables 7-6 and 7-7) would include mining, processing, and barging operations. These activities would include bulldozers (or loaders) moving excavated materials, loaders working near the processing plant feeding the conveyors or filling trucks, and a barge being loaded. Because these activities would generally occur during daytime hours, they would have to meet King County's allowable daytime sound level of 57 dBA for an industrial noise source affecting rural residential receivers. If these activities occurred prior to 7 a.m. on weekdays, the nighttime sound level of 47 dBA would have to be met.

Nighttime activities for this analysis were assumed to consist of the loading of barges using the conveyor system and one loader located near the processing plant feeding the conveyor to the barge. These activities would be required to meet King County's allowable nighttime limit of 47 dBA.

Under calm conditions, during the day, measured sound levels at residential receptors ranged from 42 to 51 dBA (Table 7-6). Modeled sound levels under the Proposed Action during daytime hours ranged from 41 to 49 dBA, with the highest sound levels occurring during Phase 1 and Phase 3 of the mining operation near the west property boundary. As shown in Table 7-6, sound levels under calm conditions with maximum production would meet King County's allowable daytime sound level of 57 dBA. Under nighttime conditions with barge loading activities taking place, sound levels would also be within King County's allowable nighttime limit of 47 dBA.

Sound levels with a wind speed of 2 meter/second and maximum production are shown in Table 7-7. With a 2 meter/second wind blowing from the primary noise sources toward each receptor, the noise model estimates that project-related sound levels would comply with King County's daytime and nighttime standards at all locations except at individual residences represented by receptor location GB7 in the Gold Beach community. Receptor GB7 is located in a residential area on a hill overlooking the Gold Beach community (see Figure 7-1). By Phases 5 and 6 of the mining operation, most of the intervening topography on the project site would have been excavated. Sound level estimates at GB7 indicate that sounds from nighttime barge-loading operations could exceed the 47 dBA limit at night with a wind blowing from the southwest to the northeast.

7.3.1.4 Alternatives 1 and 2

Under Alternatives 1 and 2, the same general operations would take place at the site, but at lower levels of activity (i.e., the number of barges loaded per day and the hours of equipment operation would be limited, as described in Chapter 2). Sound levels under either alternative would be similar to those described for the Proposed Action but would occur for shorter periods of time. In addition, nighttime sound levels would be lower because fewer barges would be loaded. Other impacts would be similar to those described for the Proposed Action and would not exceed applicable regulatory standards.

7.3.1.5 No-Action

Under the No-Action Alternative, periodic mining activities would continue as they have in the past, with approximately 20,000 tons of material being mined per year for on-island markets. Impacts associated with the No-Action Alternative would be minimal.

7.4 Mitigation Measures

7.4.1 Measures Already Proposed by the Applicant or Required by Regulation

The following measures have been proposed by the applicant to minimize impacts associated with the project:

- Construction of a 12-foot berm along the western perimeter and in the northeastern corner of the site to ensure that there would always be a sufficient barrier between operating equipment and nearby residences.

- Regular maintenance of the conveyor system and the barge loading conveyor to ensure that squeaking of the equipment is minimized.

- Use of strobe lights instead of audible alarms for back-up warning devices used onsite during nighttime operations.

Incorporation of these mitigation measures into the construction and operation of the project would ensure compliance with the King County Noise Code and would result in sound levels lower than those allowed by the code.

7.4.2 Additional Measures for Consideration to Further Reduce Impacts

In addition to the mitigation measures identified above, the following measures could be considered as a means of further reducing impacts associated with the project:

- Employ radar-based backup warning systems on all heavy equipment. Such systems detect objects or people in the equipment's path when the equipment is moving in reverse. The system produces an audible warning only when an object or person is detected to be at an unsafe distance from the equipment. By using this type of warning system, the annoyance noise associated with backup alarms could be eliminated. Approval by the Washington State Department of Labor and Industry for this type of alarm system would be required.

- The applicant could engage the services of an independent consultant to monitor sound levels produced by noise-

generating activities and report such findings to King County to ensure compliance with noise standards. Monitoring would be conducted at or near the residential locations exposed to the highest project-related sound levels during the monitoring period. Monitoring would commence when any noise-generating activity begins on the project site. Once every 3 months, the applicant would submit a short letter report summarizing the results of the monitoring program. If the County determines that project-related activities are resulting in violations of noise criteria, the County would notify the applicant who would then be required to implement additional measures to bring project-related sound levels into compliance with the criteria identified earlier.

- The County could establish an advisory committee to monitor and evaluate complaints relating to the project. The advisory committee would be composed of representatives of the mining operator, area residents, and King County staff. As needed, the committee would make recommendations for actions to be taken by the mining operator to reduce or eliminate noise complaints.

- The site buffer could be expanded along the eastern and western perimeter to reduce noise and increase screening provided by topography. (See Figure 11-8 in Chapter 11.)

7.5 Cumulative Impacts

None expected.

7.6 Significant Unavoidable Adverse Impacts

Using King County Code as the threshold of significance, significant impacts can be avoided through mitigation, especially construction of the earthen berm barrier along the western perimeter and in the northeast corner of the site to shield nearby residences. Nevertheless, many people within the Gold Beach and Sandy Shores communities would be able to hear mining activity at the site.

7.7 Citations

McCulley, Frick & Gilman, Inc. 1998. Environmental noise analysis for expanded environmental checklist, Lone Star Northwest Maury Island mining expansion. April 21. Included as Appendix E to: Huckell/Weinman Associates, Inc. 1998. Expanded environmental checklist for Northwest Aggregates Maury Island mining operation. May.

RTA Software Pty Ltd. 1989. User's guide for the environmental noise model (ENM). Distributed by Scantek, Inc., Rockville, MD.

U.S. Environmental Protection Agency. 1971. Noise from construction equipment and operations, building equipment, and home appliances, NTID300.1.

This page left blank intentionally

Table 7-1. Weighted Sound Levels and Human Response

Sound Source	*dBA**	*Response Criteria*
Carrier deck jet operation	140	Limit amplified speech
Limit of amplified speech	130	Painfully loud
Jet takeoff (200 feet) Auto horn (3 feet)	120	Threshold of feeling and pain
Riveting machine Jet takeoff (2,000 feet)	110	
Shout (0.5 foot) New York subway station	100	Very annoying
Heavy truck (50 feet) Pneumatic drill (50 feet)	90	Hearing damage (8 hour exposure)
Passenger train (100 feet) Helicopter (in-flight, 500 feet) Freight train (50 feet)	80	Annoying
Freeway traffic (50 feet)	70	Intrusive
Air conditioning unit (20 feet) Light auto traffic (50 feet)	60	
Normal speech (15 feet)	50	Quiet
Living room Bedroom Library	40	
Soft whisper (15 feet)	30	Very quiet
Broadcasting studio	20	
	10	Just audible
	0	Threshold of hearing

* Typical A-weighted sound levels taken with a sound-level meter and expressed as decibels on the scale. The "A" scale approximates the frequency response of the human ear.

Source: U.S. Council on Environmental Quality 1970.

Table 7-2. King County Environmental Noise Limits (dBA)

District of Noise Source	*District of Receiving Property*			
	Rural Day/Night	*Residential Day/Night*	*Commercial*	*Industrial*
Rural	49/39	52/42	55	57
Residential	52/42	55/45	57	60
Commercial	55/45	57/47	60	65
Industrial	57/47	60/50	65	70
Source: King County Code, Chapter 12.88.				

Table 7-3. Existing Sound Levels (dBA)

Hours	L_{eq}[1]	L_{02}[2]	L_{08}[3]	L_{25}[4]	L_{90}[5]
Gold Beach[6]					
7 a.m. – 10 p.m.	43-51	51-57	47-53	43-51	35-47
10 p.m. – 7 a.m.	38-45	46-53	40-49	36-46	32-42
Sandy Shores[7]					
7 a.m. – 10 p.m.	43-53	51-61	47-54	42-51	34-46
10 p.m. – 7 a.m.	37-46	43-52	39-49	34-47	32-41

1 The equivalent sound level (the level of a steady sound that contains the same acoustical energy as the fluctuating noise over a given time period, such as one hour)

2 Sound level that is exceeded 2.5% of the time or 1.5 minutes per hour

3 Sound level that is exceeded 8.3% of the time or 5 minutes per hour

4 Sound level that is exceeded 25% of the time or 15 minutes per hour

5 Sound level that is exceeded 90% of the time or 54 minutes per hour

6 The sound level meter was placed on the back deck of 25914 Gold Beach Drive and overlooked Puget Sound. This location has a clear view to the barge loading dock. Noise sources audible while present at this location were water lapping on the shore, airplanes, and nearby residential activities.

7 The sound level meter was placed in the backyard of 8909 SW 274th Street. This location was on a hill overlooking Puget Sound and the existing dock. Noise sources audible while present at this location were wind in the trees, distant airplanes, the HVAC system of the residence, and activity of the resident outside.

Source: McCulley, Frick & Gilman 1998.

Table 7-4. Typical Construction Equipment Sound Levels

Types of Equipment	*Range of Noise Levels (dBA)*	
	At 50 Feet	*At 1,000 Feet*
Clearing		
Bulldozer	77-96	51-70
Dump Truck	82-94	56-68
Grading		
Scraper	80-93	54-67
Bulldozer	77-96	51-70
Paving		
Paver	86-88	60-62
Dump Truck	82-94	56-68
Stationary Equipment		
Generators	71-82	45-56
Compressors	74-87	48-61

The range of sound levels presented stem from the variety of types of equipment that may be used for particular tasks as well as the different sound levels that may be produced by different operational modes of the same equipment. For example, some equipment will make more noise when handling heavy loads than when simply idling.

Source: U.S. Environmental Protection Agency 1971.

Table 7-5. Summary of Source Sound Levels

Source	*L25 (in dBA at 100 feet)*
Processing Plant[1]	83
Barge Loading[2]	64
Bulldozer[3]	83
Front-End Loader[4]	83

[1] Measured the crusher plant operating at Lone Star's Mats Mats pit.

[2] Measured the sound levels of a barge being loaded at Lone Star's Dupont facility. The material being loaded, rock mixed with sand, is anticipated to be similar to the material extracted from the Maury Island pit. The sound level of the loading represented above does not include the warning alarm sounded at the onset of loading or the squeaks of the conveyor. Both of these sounds are louder than the barge loading but can be effectively mitigated through the use of strobe lights for the alarm and adequate maintenance for the squeaky equipment. See Section 7.5, Mitigation Measures.

[3] Measured a CAT D10 bulldozer operating at Lone Star's Dupont site over several cycles of the dozer moving material.

[4] Measured a CAT 992 front-end loader at Lone Star's Dupont site over several cycles of the loader excavating material and dumping it into a hopper.

Source: McCulley, Frick & Gilman 1998.

Table 7-6. Operational Sound Levels—Calm Conditions

Receptor		Measured Existing Sound Levels (L25s)	Calculated Sound Levels (dBA)						King County Allowable Level
			Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	
Gold Beach									
GB1	Day	43-51	36	33	33	35	33	46	57
	Night	36-46	32	32	32	32	32	32	47
GB2	Day	43-51	37	32	32	36	33	46	57
	Night	36-46	32	32	32	32	32	32	47
GB3	Day	43-51	38	32	32	36	33	45	57
	Night	36-46	31	31	31	31	31	31	47
GB4	Day	43-51	35	27	27	34	29	43	57
	Night	36-46	24	24	24	24	26	26	47
GB5	Day	43-51	37	30	30	37	33	44	57
	Night	36-46	29	29	29	29	30	30	47
GB6	Day	42-51	33	38	30	31	39	41	57
	Night	34-47	26	27	27	27	31	31	47
GB7	Day	42-51	32	41	31	32	44	45	57
	Night	34-47	19	24	24	24	33	33	47
GB8	Day	42-51	32	38	31	31	40	41	57
	Night	34-47	17	21	21	21	30	30	47
Residences on Hill West of Site									
W1	Day	42-51	47	43	45	50	41	41	57
	Night	34-47	32	36	36	36	36	36	47
W2	Day	42-51	49	45	47	45	38	41	57
	Night	34-47	32	31	31	31	31	31	47
W3	Day	42-51	44	39	48	40	37	37	57
	Night	34-47	28	32	32	32	32	32	47
Sandy Shores									
SS1	Day	43-51	42	40	39	42	39	42	57
	Night	36-46	37	38	38	38	38	38	47
SS2	Day	43-51	42	42	37	42	38	41	57
	Night	36-46	35	36	36	36	36	36	47
SS3	Day	43-51	42	41	36	37	38	40	57
	Night	36-46	34	35	35	35	35	35	47
SS4	Day	43-51	39	39	35	36	36	40	57
	Night	36-46	33	34	34	34	34	34	47
SS5	Day	42-51	45	40	38	44	41	41	57
	Night	34-47	31	33	33	33	35	35	47
SS6	Day	42-51	46	43	43	52	42	42	57
	Night	34-47	36	37	37	37	37	37	47

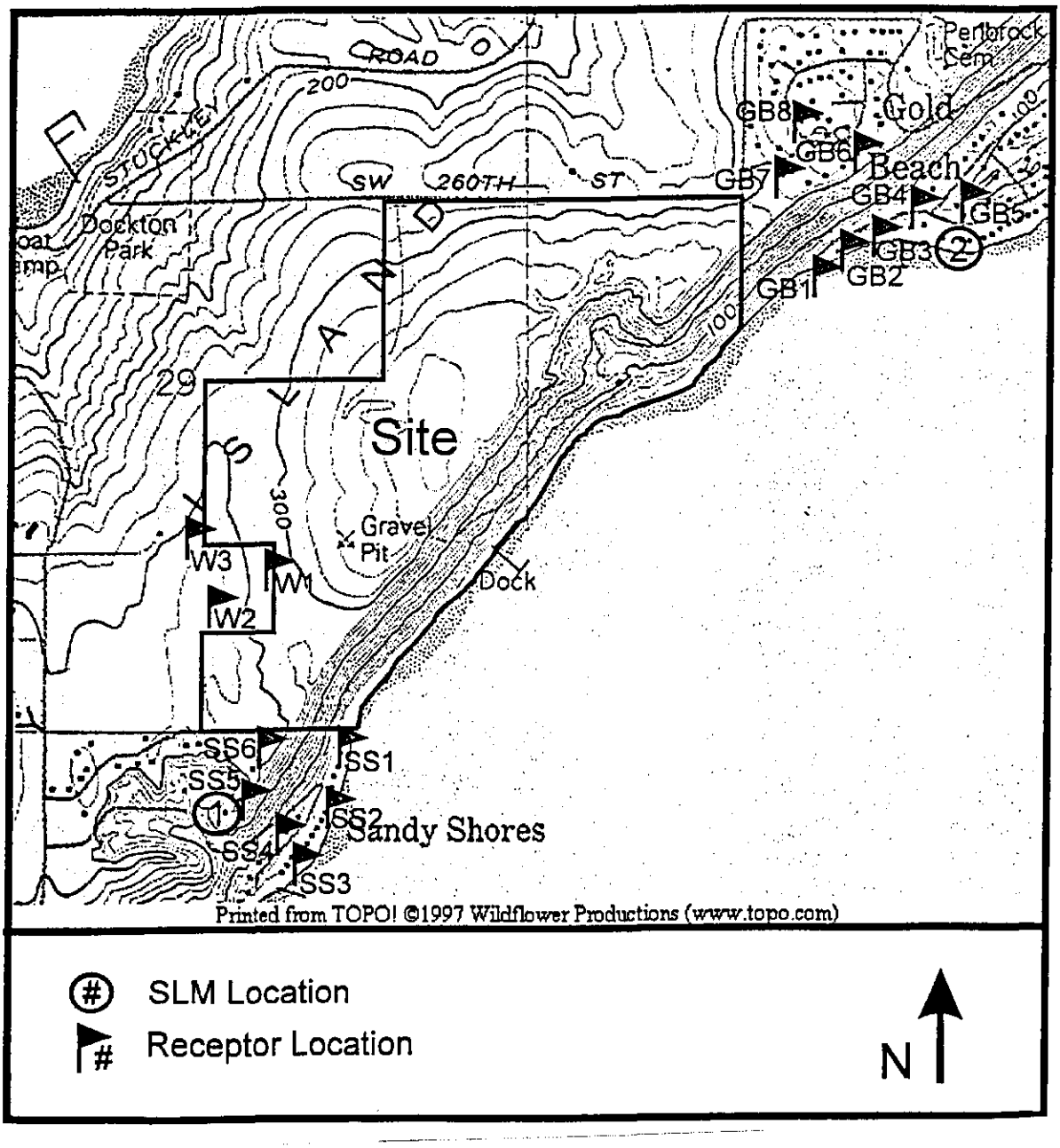
Source: McCulley, Frick & Gilman 1998.

Table 7-7. Operational Sound Levels—with 2 m/s Wind

Receptor		Measured Existing Sound Levels (L25s)	Calculated Sound Levels (dBA)						King County Allowable Level
			Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	
Gold Beach									
GB1	Day	43-51	46	39	39	47	42	50	57
	Night	36-46	38	38	38	38	39	39	47
GB2	Day	43-51	46	39	39	47	44	50	57
	Night	36-46	37	38	38	38	39	39	47
GB3	Day	43-51	46	39	39	47	47	52	57
	Night	36-46	37	38	38	38	41	41	47
GB4	Day	43-51	44	42	43	46	49	52	57
	Night	36-46	34	36	36	36	40	40	47
GB5	Day	43-51	45	50	50	51	50	53	57
	Night	36-46	36	42	42	42	45	45	47
GB6	Day	42-51	47	49	47	47	54	53	57
	Night	34-47	38	40	40	40	47	47	47
GB7	Day	42-51	46	50	47	47	56	55	57
	Night	34-47	34	37	37	37	***48****	***48****	47
GB8	Day	42-51	46	49	46	47	54	54	57
	Night	34-47	33	36	36	36	46	46	47
Residences on Hill West of Site									
W1	Day	42-51	56	48	49	50	46	46	57
	Night	34-47	37	40	40	40	40	40	47
W2	Day	42-51	56	54	53	48	48	49	57
	Night	34-47	41	39	39	39	38	38	47
W3	Day	42-51	54	47	52	45	43	44	57
	Night	34-47	33	38	38	38	37	37	47
Sandy Shores									
SS1	Day	43-51	48	51	44	46	48	50	57
	Night	36-46	43	43	43	43	43	43	47
SS2	Day	43-51	49	51	46	49	48	49	57
	Night	36-46	41	42	42	42	42	42	47
SS3	Day	43-51	50	50	45	44	47	48	57
	Night	36-46	40	41	41	41	41	41	47
SS4	Day	43-51	48	50	42	43	47	48	57
	Night	36-46	40	40	40	40	40	40	47
SS5	Day	42-51	53	52	50	51	50	50	57
	Night	34-47	44	44	44	44	44	44	47
SS6	Day	42-51	54	52	51	55	51	51	57
	Night	34-47	44	45	45	45	45	45	47

* The modeled sound level exceeds King County's allowable limit.

Source: McCulley, Frick & Gilman 1998.



Source: McCulley, Frick & Gilman 1998.

Figure 7-1. Sound Level Measurement and Receptor Locations